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Specification

Title of the Invention:

Hard disk drive and electric conductor sheet used for the same

Detailed Description of the Invention:

[0001]

[Field of the invention]

The present invention relates to a hard disk drive configured by storing disk construction members such as a disk and a head in its enclosure and an electric conductor sheet used for the hard disk drive.

[0002]

[Background art]

Hard disk drives having various configurations have been known so far which have been respectively configured by storing disk construction members such as a disk and a head in its enclosure. In recent years, the number of hard disk drives respectively using a GMR (giant magnetoresistive) head has been increased in order to achieve higher recording densification and downsizing. It is known that the GMR head is weak in electrostatic discharge (hereafter referred to as ESD). Therefore, it has been necessary to carefully operate the hard disk drives.

[0003]

A conventional hard disk drive mounting a GMR head is used as one component of a PC but it is not frequently freely operated

by a general end user. Therefore, it is enough to consider only operator's operating a hard disk drive when manufacturing a PC. That is, a conventional hard disk drive is configured by storing disk construction members in an enclosure composed of a top cover while exposing the electronic-card side. Moreover, the electronic-card side of the hard disk drive is not touched by the operator but the top-cover side is touched by the operator and it may have an ESD damage. Therefore, it is enough to take action for ESD from the top-cover side.

[0004]

[Problems to be solved by the invention]

However, it is scheduled that a general end user operates the whole compact hard disk drive such as a 1"-type hard disk drive currently being developed. Therefore, when it is possible for a general end user to freely operate a hard disk drive, a hazard is easily estimated that the drive receives ESD from every direction. Therefore, the above compact hard disk drive must withstand ESD at any location. However, ESD preventive actions must be further taken for hard disk drives hitherto known because only operating of them by specific operators having the knowledge of ESD is considered.

[0005]

The present invention is made to solve the above problems and its object is to provide a hard disk drive not damaged due to ESD even if the drive is operated by a general end user and an electric conductor sheet used for the drive.

[0006]

[Summary of the invention]

According to a first aspect of the invention there is provided a hard disk drive comprising an enclosure including disk construction members, wherein the enclosure is covered with an electric conductor sheet, and wherein at least portions where the enclosure and the disk construction members contact each other on both principal planes of the enclosure are respectively covered with the electric conductor sheet and the electric conductor sheets on both principal planes are electrically connected.

According to a second aspect of the invention there is provided a hard disk drive comprising an enclosure including disk construction members, wherein at least both principal planes of the enclosure are respectively covered with the electric conductor sheet and the electric conductor sheets on both principal planes are electrically connected.

In case of the present invention, ESD is absorbed by an electric conductor sheet by covering an enclosure with the electric conductor sheet even if ESD is applied to the enclosure from any direction and thereby, ESD does not pass through the disk construction members stored in the enclosure. Therefore, it is possible to form a structure in which a GMR head or the like in an enclosure are not damaged due to ESD even if the enclosure is handled by a general end user. Moreover, the present invention relates to an electric conductor sheet for covering at least both principal planes of the enclosure of a hard disk drive constituted as described above.

Preferable modes are described below. That is, at least both principal planes of an enclosure are respectively covered with an electric conductor sheet so that the electric conductor sheets on both principal planes are electrically connected. Moreover, portions where an enclosure contacts with disk construction members on both principal planes of an enclosure are respectively covered with an electric conductor sheet so that the electric conductor sheets on both principal planes are electrically connected. Furthermore, both principal planes are covered with one electric conductor sheet. Furthermore, an electric conductor sheet is bonded to the surface of an enclosure by an adhesive. Furthermore, an electric conductor sheet is provided with an opening at a position corresponding to an enclosure portion that must be brought into contact with an external atmosphere. Any one of the above cases makes it possible to more effectively realize a structure not damaged due to ESD.

[0008]

[Preferred embodiment]

Figures 1, 2, and 3 show the configuration of a hard disk drive of the present invention. In Figures 1, 2, and 3, symbol 1 denotes an enclosure for storing disk construction members (not illustrated) such as a magnetic disk and a GMR head and 2 denotes a metallic seal serving as an electric conductor sheet. In this case, Figure 1 is an illustration showing a state in which a hard disk drive of the present invention is manufactured and Figures 2 and 3 are illustrations showing the upper plane and the lower plane of a hard disk drive of the present invention. A hard disk drive of the present invention is characterized by covering an enclosure 1 with a metallic seal 2. That is, in the case of the example shown in Figures 1 to 3, a hard disk drive of the present invention is configured by preparing one metallic seal 2 capable of covering both principal planes of the enclosure 1, that is, almost whole of the upper plane 1a, lower plane 1b, and side plane 1c as shown in Figure 1, applying an adhesive to the entire surface facing the upper plane 1a, lower plane 1b, and side plane 1c of the enclosure 1 of the metallic seal 2, and bonding the metallic seal 2 to the enclosure 1 so as to cover the upper plane 1a, lower plane 1b, and side plane 1c of the enclosure 1.

[0009]

The obtained hard disk drive is constituted so as to respectively cover both principal planes, that is, the upper plane 1a and lower plane 1b of the enclosure 1 with the metallic seal 2. Moreover, the metallic seals 2 on the principal planes are electrically connected each other by covering even the side plane 1c between the upper plane 1a and the lower plane 1b with one metallic seal 2. Furthermore, as shown in Figures 1 to 3, when the metallic seal 2 is applied to almost the entire surface of both principal planes, portions where the enclosure 1 contacts disk construction members on

both principal planes of the enclosure 1, that is, the spindle portion serving as the rotation center of a disk and the pivot portion serving as the moving center when moving a GMR head on the disk are covered with the metallic seal 2.

[0010]

It is preferable to cover at least the portions where the enclosure 1 contacts disk construction members on both principal planes of the enclosure 1 with the metallic seal 2 or it is more preferable to cover almost the whole of both principal planes with the metallic seal 2 because of the following reasons. That is, first, when the metallic seal 2 is provided for only one principal plane as shown in Figure 4(a), if ESD is applied to the metallic seal 2, for example, ESD passes through a spindle 3 from the metallic seal 2 and propagates to a plane provided with no metallic seal 2 as shown by an arrow and thereby, a GMR head stored in the enclosure 1 may be damaged due to ESD. However, when one metallic seal 2 is provided for both principal planes and the side plane of the present invention shown in Figure 4(b), even if ESD is applied to the metallic seal 2 at the upper plane, ESD propagates from the metallic seal 2 at the upper plane to the metallic seal 2 at the lower plane through the metallic seal at the side plane and thereby, a GMR head and the like stored in the enclosure 1 are not damaged due to ESD.

[0011]

An aluminum seal made of an aluminum foil can be preferably used as the metallic seal 2 among members constituting a hard disk drive of the present invention. Moreover, any adhesive can be used as the adhesive for bonding the metallic seal 2 to the enclosure 1 as long as it can fix the seal 2 and the enclosure 1. However, it is preferable to use an acrylic-based adhesive such as PAT-1 made by Lintec Corporation. Furthermore, as shown in Figures 1 to 3, it is possible to add characters and symbols showing a product name or the like on

the surface of the metallic seal 2. In this case, it is impossible to directly print characters or symbols on the surface of the metallic seal 2. However, by forming a layer such as an adhesive layer on the surface of the metallic seal 2, it is possible to print characters and symbols on the surface of the adhesive layer. Moreover, though the example shown in Figures 1 to 3 shows the metallic seal 2 having no opening, it is possible to form an opening at the position of the metallic seal 2 corresponding to a portion of the enclosure 1 which must be directly brought into contact with an external atmosphere such as the hole of a breather filter.

[0012]

In the case of the above hard disk drive of the present invention, the metallic seal 2 is insulated because it is only bonded to the enclosure 1 by an adhesive. It is permitted that the surface of the metallic seal 2 is made of a conductor or insulator. Moreover, the areas of the upper plane 1a and the lower plane 1b of the enclosure 1 of the hard disk drive are almost covered with the metallic seal 2. In this case, because most points weak in ESD present on the enclosure 1 of the hard disk drive including the above spindle and pivot are covered with the metallic seal 2, they are protected from ESD. It is found through an ESD test that most ESD is absorbed by the metallic seal 2. Though the aluminum seal used for the hard disk drive of the present invention has a thickness of approx. 40 μm including the insulating layer, the potential applied to the hard disk drive covered with an aluminum seal is 500 V or lower to a discharge of 10 kV. This is the same value as the case of protecting the hard disk drive with a conventionally-used ESD bag and shows that a voltage applied to the hard disk drive can be lowered.

[0013]

In fact, the hard disk drive of the present invention providing the metallic seal 2 for the enclosure 1 as shown in Figures 1

to 3 and the hard disk drive of a comparative example provided with no metallic seal 2 were prepared and an ESD test was performed for the prepared hard disk drives of the present invention and the comparative example in accordance with IEC61000-4 which is the European test standard for obtaining a CE mark. As a result, it is found that the hard disk drive of the comparative example cannot pass the test at ESD 8,000 V or cannot obtain the CE mark but the hard disk drive of the present invention can pass the test even at ESD 25,000 V and obtain the CE mark.

[0014]

[Advantages of the invention]

As described above, according to the present invention, because the enclosure of a hard disk drive is covered with an electric conductor sheet, ESD is absorbed by the electric conductor sheet even if ESD comes from any direction and thereby, ESD does not pass through disk construction members stored in the enclosure. Therefore, it is possible to realize a structure not damaged due to ESD even if the structure is handled by a general end user.

4. Brief Description of the Drawings:

Figure 1 is an illustration showing the configuration of a hard disk drive of the present invention, showing a state when the hard disk drive is manufactured;

Figure 2 is an illustration showing the configuration of a hard disk drive of the present invention, showing the upper plane of the drive;

Figure 3 is an illustration showing the configuration of a hard disk drive of the present invention, showing the lower plane of the drive; and

Figure 4(a) is an illustration showing the flow of ESD in an example when a metallic seal is provided for only one principal plane and Figure 4(b) is an illustration showing the flow of ESD in an example when a metallic seal is provided for both principal planes.

[Description of symbols]

- 1 ... Enclosure
- 1a ... Upper plane
- 1b ... Lower plane
- 1c ... Side plane
- 2 ... Metallic seal
- 3 ... Spindle

Claims:

1. A hard disk drive comprising an enclosure including disk construction members, wherein the enclosure is covered with an electric conductor sheet, and wherein at least portions where the enclosure and the disk construction members contact each other on both principal planes of the enclosure are respectively covered with the electric conductor sheet and the electric conductor sheets on both principal planes are electrically connected.
2. The hard disk drive according to Claim 1, wherein both principal planes are covered with one electric conductor sheet.
3. The hard disk drive according to Claim 1 or 2, wherein the electric conductor sheet is bonded to a surface of the enclosure by an adhesive.
4. The hard disk drive according to any one of the preceding claims, wherein the electric conductor sheet has an opening at a position corresponding to an enclosure portion which must be directly brought into contact with external atmosphere.
5. An electric conductor sheet used for the hard disk drive of Claim 1, which covers at least both principal planes of the hard disk drive.
6. A hard disk drive comprising an enclosure including disk construction members, wherein at least both principal planes of the enclosure are respectively covered with the electric conductor sheet and the electric conductor sheets on both principal planes are electrically connected.